A new Australian Species of *Argyrodes* Simon (Araneoidea: Theridiidae) which preys on its Host

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A new species of the web-parasite spider genus *Argyrodes* is described. This spider has a close association with its only known and larger host, the tent web spider *Achaearanea mundula*. It is a predator of both the host and its eggs and young and makes use of the host's leaf retreat as a shelter for its egg sac.

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INTRODUCTION

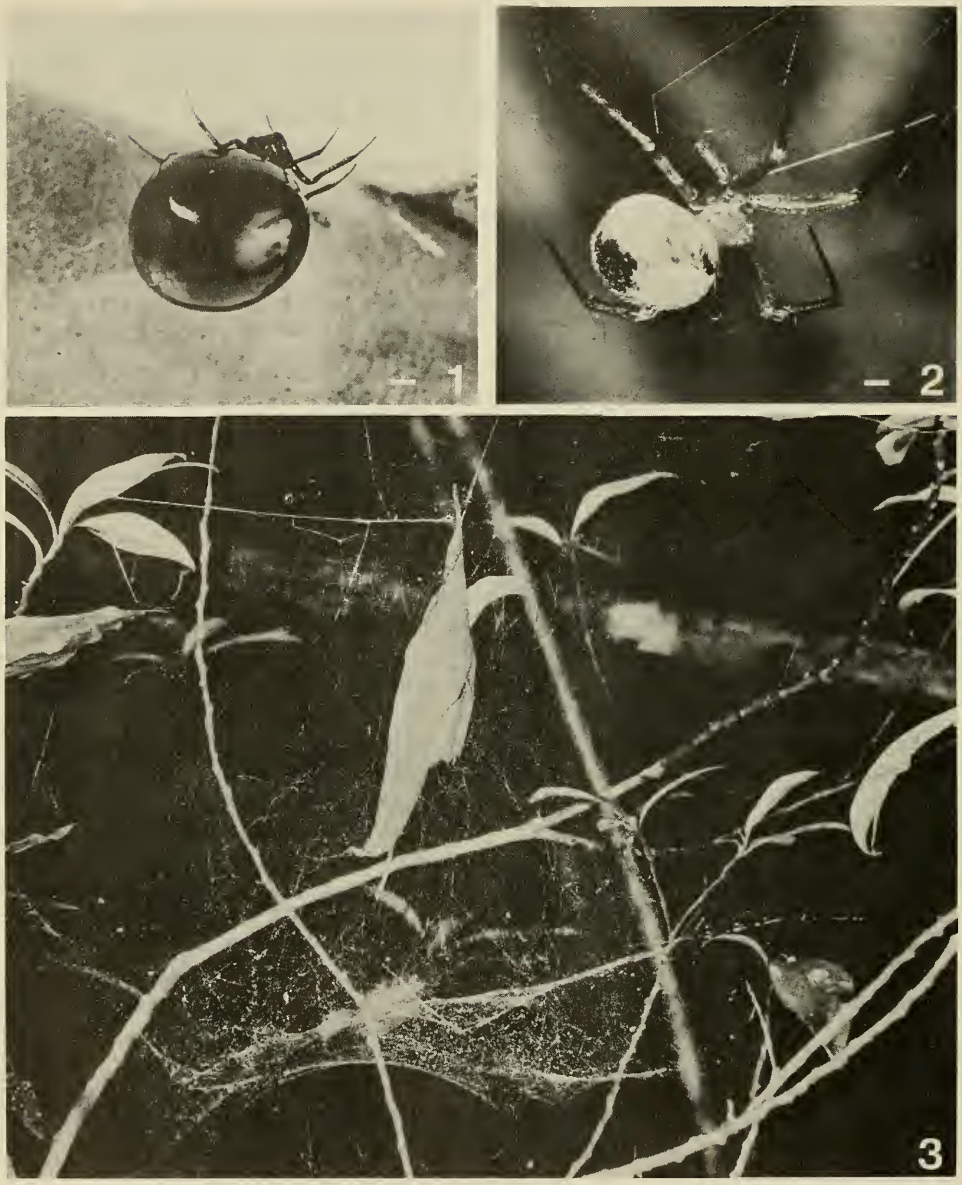
Large, complex or communal spider webs may harbour a variety of invertebrates as temporary or semi-permanent residents. The small spiders of the worldwide genus *Argyrodes* Simon (Exline and Levi, 1962) are common residents in the webs of araneoid spiders. Most live either as commensals which take small prey ignored by the host spider or kleptoparasites which steal prey captured by the host (Robinson and Robinson, 1973; Vollrath, 1979; Whitehouse, 1986). The host spider is often much larger (e.g. *Nephila* or *Argiope* spp.) than the resident *Argyrodes* so that competition for food resources would not seem likely. Several studies have shown, however, that prey stealing can have such an impact that some hosts abandon their webs and build elsewhere (Robinson and Robinson, 1976; Vollrath, 1981; Rypstra, 1981). A few temperate zone species of *Argyrodes* have become predators of both their hosts and spiderlings (Kaston, 1965). Trail (1980) has observed host predation by *A. fictilium* (Hentz) and *A. baboquivari* Exline and Levi upon linyphiid host spiders including *Frontinella* sp., and the uloborid *Philliponella oweni* Chamberlin. *A. trigonum* (Hentz) is a predator of the araneids *Metepeira labyrintha* Hentz and *Mecynogea lemniscata* Walckenaer and the linyphiid *Neriene radiata* Walckenaer (Wise, 1982; Larcher and Wise, 1985). Whitehouse (1986) noted predation by *A. antipodiana* O.P. — Cambridge upon its araneid host *Araneus pustulosa* Walckenaer while the host was moulting and virtually defenceless. Gray (1983) briefly reported upon a distinctive *Argyrodes* species from eastern Australia which showed host predation behaviour. A description of this spider and some behavioural observations are given below.

Argyrodes incursus new species

Figs 4-12

Types: Holotype male (KS 18359), Blackbutt Reserve, Newcastle, New South Wales, March 1986, G. Anderson. Paratypes: Allotype female (KS 18360), 3 females (KS 18361), data as above; 2 females (KS 12254-55), Upper Causeway and Couranga Track, Royal National Park, near Sydney, New South Wales, 4.3.1983, M. Gray and C. Horseman. Australian Museum coll.

Material examined: 2 females, Station 32, southwest of North Hummock, Lord Howe Island, New South Wales, 6.2.1971, M. Gray.



Figs 1-3. 1, *Argyrodes incursus*, 'engorged' female. 2-3, *Achaearanea mundula*: 2, female; 3, web. Scale lines: Figs 1-2, 1.0mm.

Diagnosis. Male palp with marginal coiled embolus, abdomen with dorsal scute. Female with orange-red spot on posterodorsal abdomen, abdomen rounded.

Male. Total length 2.18. Carapace length 0.90, width 0.63. Abdomen length 1.27, width 0.89. Leg 1 segment lengths: femur 1.07, patella 0.33, tibia 0.63, metatarsus 0.65, tarsus 0.45. Carapace, sternum and mouthparts dark brown. Abdomen dark brown dorsally and basally; remainder black apart from 4 small orange spots placed around the base of the spinnerets (Figs 4, 5). Femora and tibiae of legs 1 and 2 dark brown, femora 2 lighter

ventrally; remaining segments reddish brown. Legs 3 and 4 reddish brown, femora lightest. Cheliceral groove with 3 promarginal, 1 retromarginal teeth. A.M.E. largest, other eyes subequal. A.M.E. separated from each other by almost 2 diameters and from A.L.E. by 0.5 diameters; P.M.E. separated by 1.75 diameters. Clypeus with wide, transverse groove with numerous anterodorsally directed setae in and below groove. Transverse stridulatory ridges run across the posterolateral carapace lobes. Abdomen ovoid, widest behind middle and covered with a dorsal scute which extends anteriorly around the pedicel. A separate scute surrounds the spinnerets (Fig. 5). Dorsal pedicel margin strongly sclerotised with evenly spaced enlarged hair bases as stridulatory picks. Male palp (Fig. 11) with tightly coiled embolus (3 turns) surrounding a raised central tegular area. Embolus supported marginally by a membranous conductor. Radix apical, triangular and lying adjacent to the elongate median apophysis.

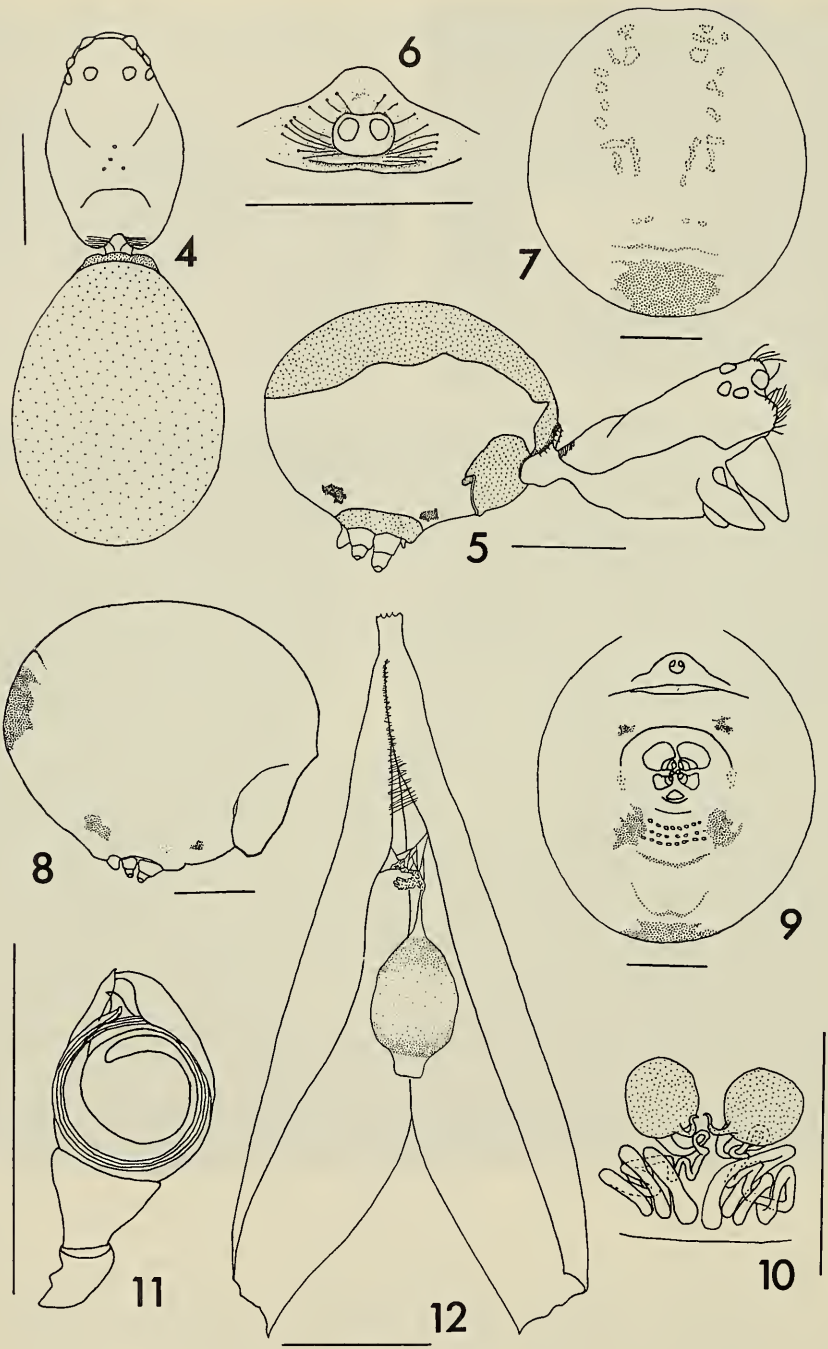
Female. Total length 3.36-4.33. Carapace length 1.29-1.35, width 0.88-0.92. Abdomen length 1.97-3.00, width 1.80-2.55. Leg 1 segment lengths: femur 1.20-1.25, patella 0.35-0.38, tibia 0.80-0.96, metatarsus 0.80-0.88, tarsus 0.50-0.62. Carapace, sternum and mouthparts dark brown. Legs 1-3 dark brown except metatarsi and tarsi which are reddish brown; leg 4 reddish brown. Abdomen ovoid to spherical, black with two indistinct rows of unpigmented spots anterodorsally. Posterodorsal abdomen with a large orange-red spot (occasionally divided into two unequal spots), bounded anteriorly and posteriorly by 1 or 2 narrow transverse orange bars (Figs 7, 8, 9). Four small irregular orange spots are grouped around the spinnerets. Epigynum (Fig. 6) a low mound surmounted by two ovoid fossae separated by about half a diameter. Internal genitalia (Fig. 10) with more or less spherical receptacula separated by about half their width. Sperm ducts strongly convoluted.

Morphology and Behaviour

Both the shape and coloration of the abdomen of *Argyrodes incursus* are unusual. Elongation, shoulder or posterior tubercles and silvery ornamentation are common features of the *Argyrodes* abdomen (Exline and Levi, 1962). In unfed female specimens of *A. incursus* the abdomen is ovoid but expands considerably after feeding into a smooth sphere (Fig. 1). A prominent orange-red spot (absent in males) on the posterodorsal abdomen contrasts markedly with the shiny black coloration of the remainder. The function of this distinctive female colour pattern is not understood but may have some aposematic benefit, such as providing protection from other web-invading predators (e.g. mimetid spiders or wasps). A dark brown dorsal scute covers the male abdomen. The male palp is unusual in that the tegulum forms a central 'drum' around which the coiled embolus is wound.

A. incursus was always found in association with the 'tent web' spider, *Achaearanea mundula* (L. Koch). This spider (Fig. 2) is common in open forest habitats in eastern New South Wales and Queensland. Populations with which *A. incursus* was associated were located at Newcastle, Sydney, and Lord Howe Island, New South Wales. *Ach. mundula* builds a complex web consisting of a knockdown maze of threads above a finely woven horizontal sheet (Fig. 3). The curled leaf or litter retreat is placed at the centre of the knockdown maze; this provides a refuge for the spider and its egg sacs (up to 6). The webs are usually built among low understorey foliage. They also harbour commensal/kleptoparasitic species of *Argyrodes* plus uloborid and mimetid spiders; the latter are temporary residents, well known as predators of araneoid spiders.

Specimens of *A. incursus* were found singly inside the curled leaf retreats of *Ach. mundula* individuals during February and March. In the Newcastle population, however, the catching parts of 3 host webs harboured 8, 2 and 2 *A. incursus* individuals respec-



Figs 4-12. Argyrodes incursus. **4-5**, male body: **4**, dorsal; **5**, lateral. **6**, epigynum. **7-9**, female abdomen: **7**, dorsal; **8**, lateral; **9**, ventral. **10**, female internal genitalia, dorsal. **11**, male palp, ventral. **12**, upper part of curled leaf retreat of *Ach. mundula* split open to show *A. incursus* egg sac near apex. Scale lines: Figs 4-11, 0.5mm; Fig. 12, 3.5mm.

tively, with the female hosts still occupying their retreats. Six observations were made of *A. incursus* females actually feeding upon the carcass of their host spider and/or its eggs or spiderlings, always within the leaf retreat. The dead host spiders were partially silk wrapped and their loosely woven egg sacs, if attacked, were torn open. In the Newcastle population *A. incursus* individuals also were found living inside the leaf retreats of empty *Ach. mundula* webs; in one case a male and female were found together. Some of these females had built single egg sacs at the leaf retreat apices (Fig. 12). Seven egg sacs were observed, all with the characteristic urn shape found in many species of *Argyrodes* (Exline and Levi, 1962). When present, the female sat above its sac on the stalk attachment.

At present *Ach. mundula* is the only known prey of *A. incursus*. The capacity for almost tick-like engorgement of the abdomen of *A. incursus* after feeding is particularly striking. Females may be able to survive and reproduce on the food reserves obtained from one successful predatory episode. The limited observations suggest that mating may occur within the *Ach. mundula* retreat. In addition, *A. incursus* females use the empty host leaf retreats for the protected placement of their egg sacs. All of this suggests a close, perhaps exclusive, association of *A. incursus* with its host/prey species, *Ach. mundula*.

In a study of *A. trigonum* (Hentz), Larcher and Wise (1985) observed a wide range of behaviour including commensalism, kleptoparasitism, web theft and host predation. They concluded that the nature of the interaction between *A. trigonum* and its hosts varied as a function of their relative individual sizes. This agrees with an earlier finding of Trail (1980) that *Argyrodes* species which attack their hosts are equal or larger in adult size compared with their host species. Presumably, this makes the attacker better able to overpower its prey. *A. incursus*, however is considerably smaller than its prey, *Ach. mundula*. Carapace length ranges for females of *A. incursus* and *Ach. mundula* are respectively 1.29-1.35mm (M = 1.32) and 2.17-2.58mm (M = 2.32). The mean difference of 1.00mm is highly significant ($P < 0.001$). The suggestion of Trail (1980) that an *Argyrodes* species smaller than its host would behave as a commensal or kleptoparasite rather than as a host predator is not supported in this case.

As yet, little information about the attack behaviour of *A. incursus* is available. It seems likely that the host is attacked in its retreat as all carcasses were found in retreats. Limited observations by Larcher and Wise (1985) suggest that *A. trigonum* simply approaches the host and bites it on a leg, resistance being negligible (though some hosts flee to avoid an attack). The venom is apparently quick to immobilise the prey which is wrapped after being bitten. An intriguing but anecdotal observation (Walker, 1983) notes that a spider purported to be an *Argyrodes* species entered the web of a red-back spider (*Latrodectus hasselti* Thorell) and squirted a milky substance (source unknown) onto the silk. The red-back readily ate the substance and became immobilized soon after. Such an indirect prey capture technique would provide an effective predation strategy in a small predator/larger prey system. Alternative hypotheses include stealth, the prey remaining unaware of the slowly approaching predator; or male behavioural mimicry, the predator imitating some aspect of the courtship repertoire of the prey's male.

The level and impact of *A. incursus* predation upon *Ach. mundula* populations are not clear. Data for a small sample of 17 *Ach. mundula* webs from Royal National Park near Sydney showed that only 2 webs harboured *A. incursus* individuals. By contrast 13 webs contained other presumptively kleptoparasitic/commensal *Argyrodes* residents. However, Newcastle *Ach. mundula* webs showed *A. incursus* occupancy rates of approximately 50%. This suggests that *A. incursus* predation may exert a considerable effect at least in small host populations.

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